Intermountain Region BHS/Domestic Sheep-Risk Assessment for Region 4 National Forests
Uinta-Wasatch-Cache and Ashley Forests
Results and Responses

Background

Because population viability analyses for Intermountain Region forests under the 2012 planning rule may not be completed for several years, an Intermountain Region Bighorn Sheep/Domestic Sheep Framework was developed to assist the Region's forests in assessing risks to bighorn sheep populations (Ovis canadensis, BHS). The framework employs a Risk of Contact (ROC) model that estimates the potential of BHS to foray from a Core Herd Home Range (CHHR) onto nearby domestic sheep allotments. The ROC model was initially developed for use in the Payette National Forest's Forest Plan Amendment Identifying Suitable Rangeland for Domestic Sheep and Goat Grazing to Maintain Habitat for Viable Bighorn Sheep Populations (2010). When used in the context of other factors such as population resilience and distribution, the model can assist in evaluations of risks to BHS populations for a planning unit. This document provides a brief description of BHS risk considerations including ROC model output and descriptions of Core Herd Home Ranges (CHHR) (Figure 1) on the Ashley and Uinta-Wasatch-Cache National Forests in Utah.

Data Sources and Analyses

Available telemetry and observation data were used to create Core Herd Home Ranges (CHHRs) for BHS on Intermountain Region Forest lands in Utah. Utah Department of Wildlife Resources (UDWR) biologists were involved in the identification and review of BHS CHHRs and the review of source habitat data as part of an expert review process. Multiple CHHR configurations were evaluated and final CHHR configurations were chosen with biological input from UDWR. Population and demographic information were provided by UDWR (Table 1).

Forest Responsibility Regarding ROC Analysis

Forests within the Intermountain Region that have populations of BHS carefully consider a variety of qualitative and quantitative factors to evaluate risk to BHS population persistence on their lands. Initial factors considered include resiliency of a herd (large populations have greater resiliency to extirpation from disease), continued BHS persistence even with continued disease exposure, and redundancy of herds on the planning unit.

Changes in grazing management are usually unnecessary where there is a low ROC. The modeled ROC output is a useful starting point for analysis, and is insufficient as a stand-alone metric. Limitations to the model (e.g., availability of data, model precision, and other factors such as topographical barriers that are not modeled) are also considered. The model output estimates a spatial risk of contact between BHS and an allotment area, but it does not incorporate other probabilities such as animal to animal contact, disease transmission, and the total risk of a disease event and BHS population loss. The analysis assumes a ROC level between a CHRR and an allotment using a May 1 to October 31 timeframe, and thus another important factor that is considered are the actual dates that domestic sheep are on the allotment.

If a high risk is identified, mitigations may be implemented as opportunities arise, as practicable, or upon more detailed analysis (e.g., during Forest Plan revision). Mitigating responses used to lower the overall

risk include altering timing and distribution of domestic sheep and other approaches identified in state management plans. Each forest obtains information from grazing allotment permitees, state fish and game agencies, tribes, and other entities as appropriate in order to develop the best collaborative response strategies.

Results Overview

This document reports BHS population assessments for planning unit areas that are under the purview of existing Land Management Plans pursuant to National Forest Management Act. The areas and plans covered are the Wasatch-Cache (2003), Uinta (2003), and Ashley (1984) National Forests.

Rocky Mountain BHS (*O. c. canadensis*) populations associated with National Forest Service lands account for an adult population of 265 animals (Table 1). These are associated with seven herds; four comprise the Uinta Mountains meta-population, and three comprise the Avintaquin, Mount Nebo and Wasatch Mountains populations. Another, non-established population of desert bighorn sheep may range onto western portion of the Fishlake National Forest, but as a non-established population not occupying Forest Service lands, it was not considered in this analysis.

Table 1. Population estimates and demographical characteristics used in modeling of six BHS populations associated with Core Herd Home Ranges on National Forests in Northern Utah

CHHR	Population Estimate	Adult Population	Lambs per 100 Ewes	Rams per 100 Ewes	RAM Ratio	Ewe Ratio
Uinta Mountains	155	136	22	55	0.35	0.65
Avintaquin	75	60	35	42	0.30	0.70
Mount Nebo	27	24	18	27	0.21	0.79
Wasatch Mountains	55	45	27	23	0.19	0.81

HERD SPECIFIC RESULTS AND RESPONSES

Uinta Mountains CHHR Results

The Uinta Mountains CHHR includes the northeastern portion of the Wasatch-Cache, and the northern portion of the Ashley National Forest planning units (Figure 2). It is the only CHHR associated with the Wasatch-Cache planning unit, and one of two CHHRs found on the Ashley planning unit. As such, the CHHR is viewed as important in providing habitats to support a viable population on both of these National Forests.

The Uinta Mountains CHHR is comprised of four herds (Sheep Creek/Hoop Lake, Carter Creek/Red Canyon, Bare Top Mountain and Goslin Mountain) identified in the Bighorn Sheep Management Plan (Utah DWR 2013). These herds are suspected of having a history of respiratory disease involvement. The Goslin Mountain herd, located on the eastern portion of the CHHR, experienced a die-off event in

2009 and all BHS that did not succumb were subsequently removed. A reintroduction to the area was made in 2014. In addition, a mortality event was reported that involved the Carter Creek/Red Canyon and Sheep Creek/Hoop Lake BHS herds in 2013 (Schaible pers. comm.). Disease events have not been reported in the Bare Top BHS herd. Overall, the CHHR has low lamb:ewe ratios (22 lambs:100 ewes), which may or may not be an indication of continuing disease affecting the herds. This CHHR represents the largest of the four populations of Rocky Mountain sheep associated with NFS lands in Utah. Most domestic sheep allotments are adjacent to the western portion of the CHHR on the Wasatch-Cache-Uinta NF and the Ashley NF.

Table 2 displays the modeled BHS herd-domestic sheep allotment risk of contact by allotment for the Uinta Mountains CHHR. Four allotments had high ROC (overlapped the CHHR), 6 had moderate ROC and 7 had low ROC

The resilience of the Uinta Mountains meta-population is largely found in its size. The combined adult population of the Uinta meta-population herds is estimated at 136 animals. It is the only population associated with NFS lands that currently exceeds Utah's goal of ≥ 125 animals in a population (Utah DWR Bighorn Sheep Management Plan, 2013).

Essentially all of the contact risk between domestic sheep allotments and foraying BHS is on the western boundary of the CHHR, with most of the allotments occurring on the western portion of the Ashley and Wasatch-Cache planning units. This area is associated with the Sheep Creek and Carter Creek/Red Canyon herds. A mortality event was documented for these herds in 2013 (Schaible pers. Comm.) , but the magnitude of this event is unknown. Although incomplete, trend data suggests that from 2007-2012 these two herds showed positive population growth rates (i.e. from 64 to 100 BHS).

A total of 196 BHS have been introduced into the four herds comprising the meta-population between 1983 and 2007 (Utah DWR 2013). This includes 76 animals introduced into the Goslin Mountain area prior to the extirpation of this herd in 2009. One concern for this meta-population is the connectivity of highly suitable habitat across the northern Uinta Mountains that support the 4 herds, and the potential for disease transmission among BHS across the CHHR. Contact potential between BHS in this CHHR with other CHHRs (e.g. Avintaquin) is considered low due to the distances between them.

Table 2. Uinta Mountains CHHR – Evaluation of ROC between foraying BHS and domestic sheep allotments.

Allotment	Risk of Contact
Gilbert Peak	Overlap
Hessie Lake Henrys Fork	Overlap
Panter	Overlap
Tungsten	Overlap
Red Castle	0.609
East Fork Blacks Fork	0.393
Middle Fork	0.203
Oweep	0.195
Ottoson Basin	0.188
West Fork Blacks Fork	0.169
Larson	0.079

Lambson Draw	0.053
Fall Creek	0.037
Luke Lym	0.018
Mill Creek	0.015
Little West Fork	0.013
Stillwater	0.013

Uinta Mountains CHRR Response

The Larson, Lambson Draw, Fall Creek, Luke Lym, Mill Creek, Little West Fork, and Stillwater allotments have low and tolerable ROC levels that do not require immediate response. The Red Castle, East Fork Blacks Fork, Middle Fork, Oweep, Ottoson Basin, and West Fork Blacks Fork have moderate ROC levels that require further analysis and potential responses; final allotment disposition will be made upon completion of an ongoing NEPA process. The Gilbert Peak, Hessie Lake Henrys Fork, Panter, and Tungsten allotments have high ROC due to overlap of BHS CHHRs and will require further analysis and potential responses; final allotment disposition will be made upon completion of an ongoing NEPA process.

Avintaquin CHRR Results

The Avintaquin population is the result of a transplant in 2009 when 60 animals were reintroduced into Lake Canyon and the Right Fork of Indian Canyon. The Avintaquin Core Herd Home Range is located primarily on the southwestern portion of the Ashley National Forest (Figure 3). Its population estimate (60 animals) is below Utah's goal of 125 animals. It is one of two CHHRs associated with that national forest. No disease events have been documented in this population. The CHHR borders a large number of allotments to the west that are located on the Uinta planning unit (Wasatch-Cache-Uinta National Forest), which may become a concern as the population expands. The lamb:ewe ratio for the herd is the highest for Rocky Mountain BHS populations associated with NFS lands (35 lambs:100 ewes). The Avintaquin CHHR is considered important in providing habitats to support viable populations on the Ashley National Forest.

Table 3 displays the modeled BHS herd-domestic sheep allotment ROC. One allotment had high ROC (overlapped the CHHR), 3 had moderate ROC and 17 had low ROC. Twenty-one allotments had negligible ROC and are excluded from Table 3.

Essentially all of the Risk of Contact is associated with allotments on the western border of the CHHR range on the western portion of the Ashley and eastern portion of the Uinta planning units. The proximity of the CHHR, and the connectivity of suitable habitats to these allotments, contributes to an increased risk for contact. This risk may increase as the population grows.

Table 3. Avintaquin CHHR - Evaluation of contact rates between foraying BHS and domestic sheep allotments.

Allotment	Risk of Contact
Strawberry Peak	Overlap
Avintaquin	0.158
Indian-Trail	0.151
Tabbyune	0.122
Gremo	0.062

Cabin Springs	0.062
Center Canyon	0.051
Beaver	0.047
Broad Hollow	0.046
Ingram-Soldier	0.033
Road Hollow	0.031
Jacob/Baldy	0.030
Mckinney	0.028
Trail Hollow	0.023
Davis	0.014
Cherry Creek	0.010
Streeper Creek South	0.007
Streeper Creek North	0.006
Red Ledge	0.006
Chipman	0.006
Trout Creek	0.005

Avintaquin CHRR Response

The Gremo, Cabin Springs, Center Canyon, Beaver, Broad Hollow, Ingram-Soldier, Road Hollow, Jacob/Baldy, Mckinney, Trail Hollow, Davis, Cherry Creek, Streeper Creek South, Streeper Creek North, Red Ledge, Chipman, and Trout Crek allotments have low and tolerable ROC levels that do not require immediate response. The Avintaquin, Indian-Trail, and Tabbyune allotments have moderate ROC levels that require further analysis and potential responses; final allotment disposition will be made upon completion of a forest planning NEPA process. The Strawberry Peak allotment has high ROC due to overlap of BHS CHHRs and will require further analysis and potential responses; final allotment disposition will be made upon completion of a forest planning NEPA process.

Wasatch Mountains CHHR

The Wasatch Mountains CHHR is located on the western portion of the Uinta planning unit on the Wasatch-Cache-Uinta National Forest, on the southern end of the Wasatch Mountain Range (Figure 4). It is the larger of two CHHRs contributing approximately two-thirds of the BHS population occurring on the planning unit. The national forest lands associated with this CHHR are important in providing habitats that support a viable BHS population on the Uinta planning unit of the Wasatch-Cache- Uinta National Forest.

Table 4 displays the modeled BHS herd-domestic sheep allotment ROC. The 7 allotments reported had low ROC and 5 other allotments were negligible and excluded from the table.

The Wasatch Mountain population is the result of transplant efforts between 2000 and 2007 totaling 89 animals. The Wasatch Mountains Herd is currently estimated at 45 adult animals. It is below Utah's population goal of 125 animals. A disease outbreak was documented in 2008-2009 (Schaible pers. comm.), and it currently has low recruitment rates (27 lambs:100 ewes).

The risks faced by this population are its relatively low adult population and low lamb recruitment which is possibly due to recent disease involvement. Additional analyses are needed to assess potential risks of domestic sheep management occurring both on and off NFS lands. The Wasatch population is in

close proximity to the Mt. Nebo population, and could potentially interact with the Avintaquin population, although such inter-CHHR movement risks have not been analyzed.

Table 4. Wasatch Mountains CHHR - Evaluation of contact rates between foraying BHS and domestic sheep allotments.

Allotment	Contact Rate
Little Valley-Heber	0.035
Wallsburg	0.010
Twin Peaks	0.005
Mud Creek Sheep	Negligible
Bryants Fork	Negligible
Cedar Knoll	Negligible
Mill B	Negligible

Wasatch Mountains CHRR Response

The allotments near the Wasatch Mountains CHRR all have low and tolerable ROC levels and do not require immediate response.

Mount Nebo CHHR

The Mount Nebo CHHR is located south of the Wasatch Mountains CHHR on the Uinta planning unit of the Wasatch-Cache-Uinta National Forest (Figure 5). Allotments potentially affecting this CHHR are located on the Uinta planning unit and the Manti-La Sal National Forest. As it is only one of two CHHRs on the planning unit, it is considered important to meeting the planning unit viable population requisite.

Table 5 displays the modeled BHS-domestic sheep herd contact rates. The 10 allotments reported had low ROC. An additional 3 allotments had negligible ROC and are excluded from the table.

Although domestic sheep allotments are not found in the Mount Nebo CHHR, trailing operations are a concern. Domestic sheep have been observed and removed from this CHHR. Disease is a concern in this population. The last documented disease event was 2007, which was an all-age die-off followed by low lamb recruitment (18 lambs:100 ewes). As the population potentially interacts with the Wasatch Mountains population, disease transmission between BHS in these herds is possible. Modeled contact rates between the CHHRs is currently thought to be low, however suitable habitat occurs in the foray areas between these populations.

The primary risks to this population are related to its low adult population size, low lamb:ewe recruitment rates (18 lambs:100 ewes) and currently active disease involvement status (Schaible pers. comm.). The all-age die-off in 2007 is likely responsible for the current low lamb recruitment rates (Shchaible pers. Comm.).

Table 5. Mount Nebo CHHR - Evaluation of contact rates between foraying BHS and domestic sheep allotments.

Allotment	Risk of Contact
Fountain Green	0.041
Cedar Knoll	0.015
Deep Canyon	0.005
Jones Ridge	0.002
South Sanpitch	0.002
Thistle Creek	Negligible
C Canyon S&G	Negligible
Mountain Lion	Negligible
Treasure Hill	Negligible
Johnson Ridge	Negligible

Mount Nebo CHRR Response

The allotments near the Mount Nebo CHRR all have low and tolerable ROC levels and do not require immediate response.

Figure 1. Utah Bighorn Sheep Modeled Core Herd Home Ranges

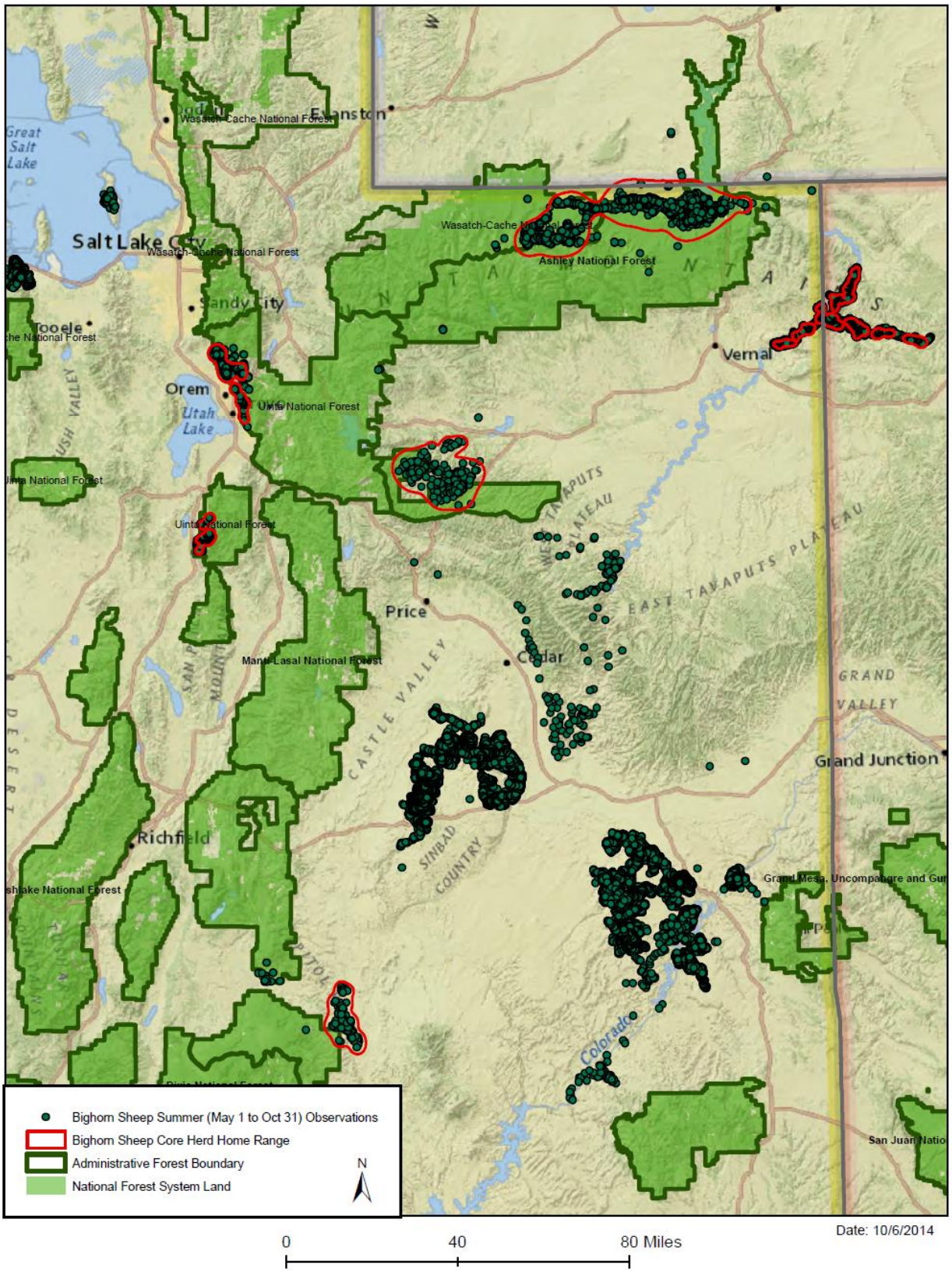
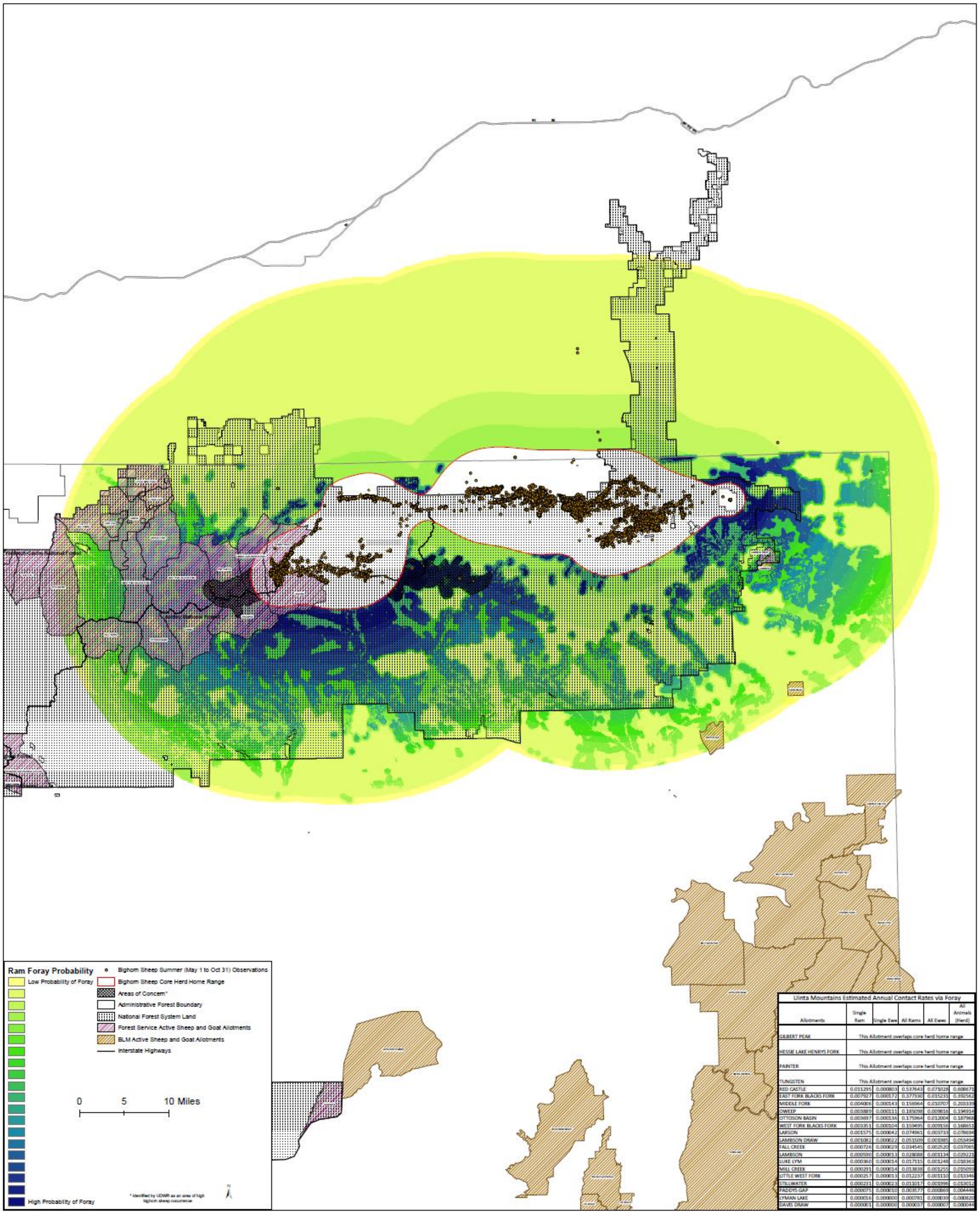


Figure 2. Uinta Mountains Core Herd Home Range/ Foray Probability Map



Uinta Mountains Estimated Annual Contact Rates via Foray

Allotments	Single Ram	Single Ewe	All Rams	All Ewes	All Animals (Herd)
GILBERT PEAK	This Allotment overlaps core herd home range				
HESSIE LAKE HENRYS FORK	This Allotment overlaps core herd home range				
PAINTER	This Allotment overlaps core herd home range				
TUNGSTEN	This Allotment overlaps core herd home range				
RED CASTLE	0.011295	0.000803	0.537643	0.071028	0.608671
EAST FORK BLACKS FORK	0.007927	0.000172	0.377330	0.015231	0.392562
MIDDLE FORK	0.004006	0.000143	0.156964	0.010707	0.203339
OWEEP	0.003889	0.000111	0.185098	0.009816	0.194914
OTTOSON BASIN	0.003697	0.000136	0.175964	0.012004	0.187968
WEST FORK BLACKS FORK	0.003351	0.000104	0.159495	0.009156	0.168651
LARSON	0.001575	0.000042	0.074961	0.003733	0.078694
LAMBSON DRAW	0.001082	0.000022	0.051509	0.001985	0.053494
FALL CREEK	0.000726	0.000029	0.034545	0.002520	0.037065
LAMBSON	0.000590	0.000013	0.028088	0.001134	0.029221
LUKE LYM	0.000360	0.000014	0.017115	0.001248	0.018363
MILL CREEK	0.000291	0.000014	0.013838	0.001255	0.015093
LITTLE WEST FORK	0.000257	0.000013	0.012237	0.001110	0.013346
STILLWATER	0.000231	0.000023	0.011017	0.001996	0.013012
PADDYS GAP	0.000075	0.000010	0.003577	0.000869	0.004446
LYMAN LAKE	0.000016	0.000000	0.000781	0.000039	0.000820
DAVIS DRAW	0.000001	0.000000	0.000037	0.000007	0.000044

Figure 3. Avinatquin Core Herd Home Range/ Foray Probability Map

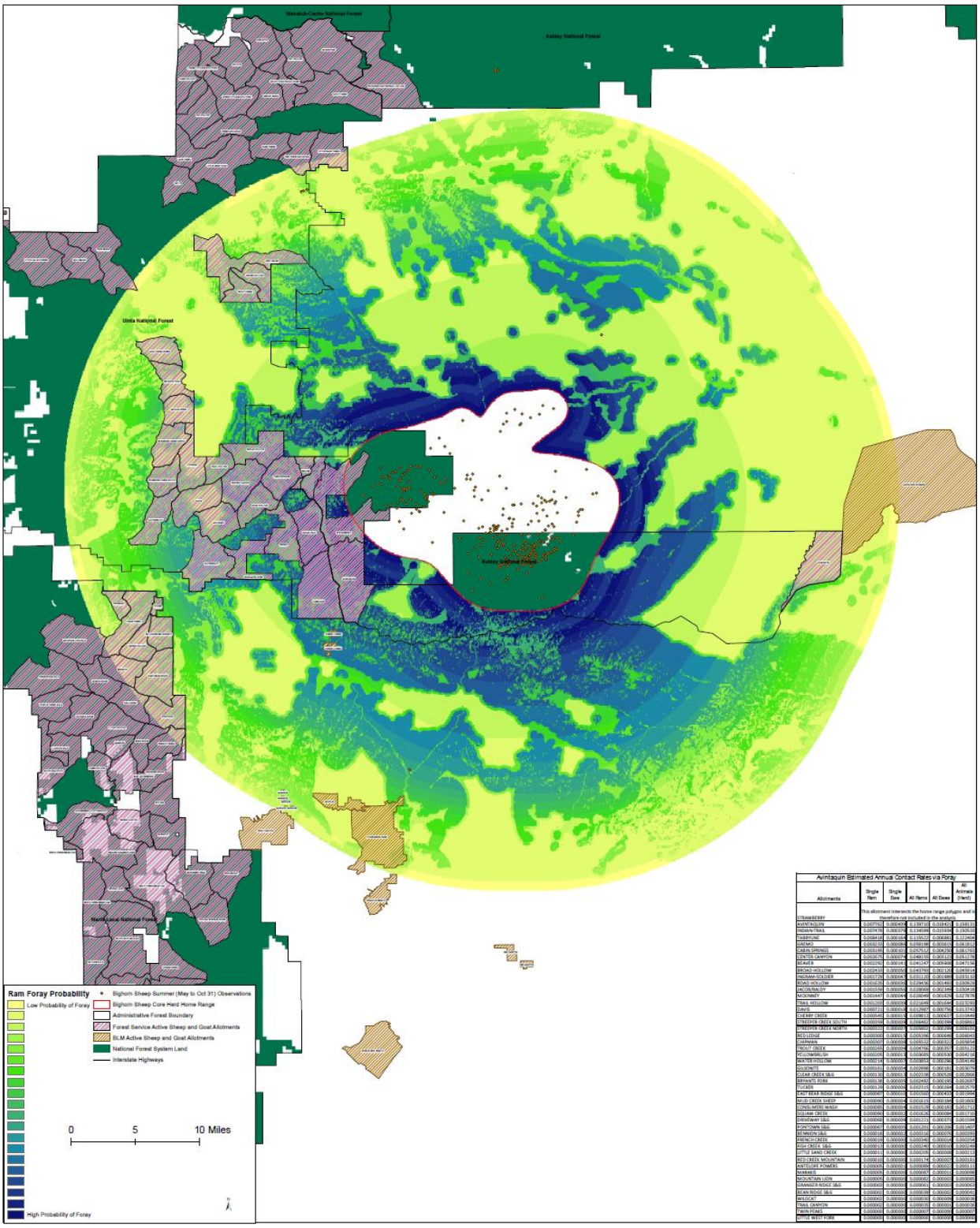


Figure 4. Wasatch Mountains Core Herd Home Range/ Foray Probability Map

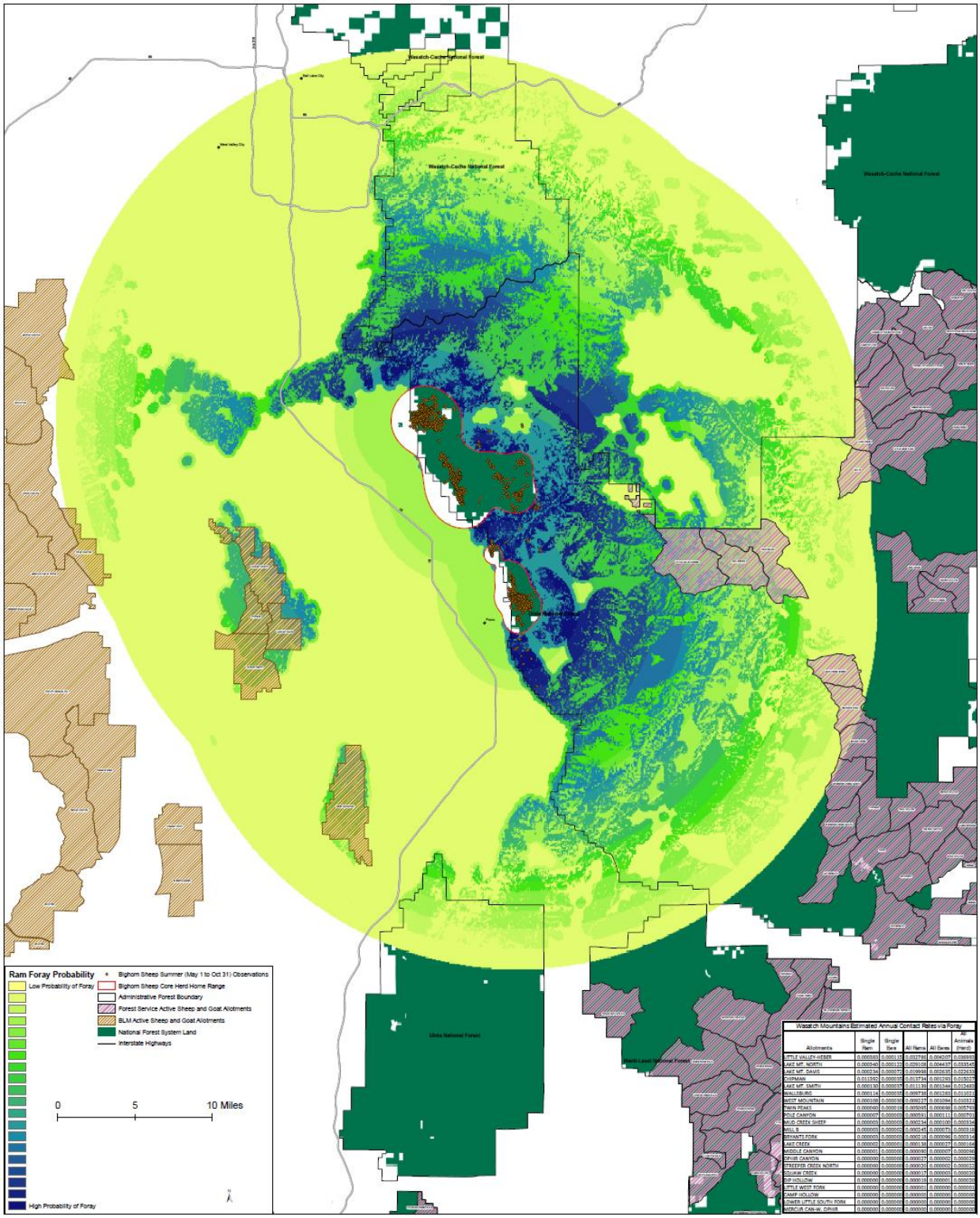


Figure 5. Mt. Nebo Core Herd Home Range/ Foray Probability Map